DOCUMENT RESUME

ED 132 131 SP 010 662

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TITLE A Simplified Evaluation Program to Distinguish Different Levels of Teacher Competence and Teacher-Pupil Interaction Patterns Based on Pupil Responses.
SPONS AGENCY Brigham Young Univ., Provo, Utah.
NOTE 33p.; Research paper submitted to Association of Teacher Educators, 1975

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS *Classroom Observation Techniques; *Computer Oriented Programs; Data Analysis; Data Collection; Data Processing; *Educational Research; Evaluation Methods; *Interaction Process Analysis; Performance Based Teacher Education; Student Behavior; *Student Teacher Relationship; Teacher Behavior; Teaching Skills
IDENTIFIERS TICOR; Time Interval and Categorical Observation Recorder

ABSTRACT

Using a modified typewriter interaction analysis system, an observer is able to record specific teacher-pupil behaviors as they interact in an instructional setting and distinguish accurately and comprehensively the cause and effect relationship. The system has the capability to distinguish patterns of behavior between different teachers in such a manner that objective analyses can be made with regard to their individual competence. Further improvement of the system has eliminated two limitations found in using the modified typewriter as the sole recorder of transcational data--the conversion of the typewriter data to computer form and the development of a duration of time measurement. The solution devised is a microcomputer system called TICOR (Time Interval and Categorical Observation Recorder) consisting of an alpha-numeric computer terminal keyboard with standard typewriter key layout plus extra keys for entering data, controlling the computer, and providing access to a larger computer. The system allows the researcher to identify teacher stimuli being used to reinforce correct responses, remediate an incorrect response, or facilitate a response to a no response. There rate, sequence, and duration investigation techniques facilitate the study of effective instructional strategies and teacher-pupil behavior. (MB)

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A Simplified Evaluation Program To Distinguish Different Levels of Teacher Competence And Teacher-Pupil Interaction Patterns Based on Pupil Responses

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SP010 662

This research was supported by university research funds from Brigham Young University.

Special recognition is given to Alpine School District for their cooperation in making this research possible.

A Simplified Evaluation Program To Distinguish Different Levels of Teacher Competence And Teacher-Pupil Interaction Patterns Based on Pupil Responses

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This paper is a report on an interaction process analysis research study using a modified typewriter as the data gathering instrument, the operant and precision teaching models as a basis for data analysis and reading instruction in the elementary grades as the research focus.

Interaction process analysis is one research procedure that has been around for a long time. The fact that it is still being used in many current research projects attests to the viable position it holds as a research tool.

INTRODUCTION

Teacher Educators are faced with the questions of; what is good teaching?, what competencies shall institutions teach their potential teachers?, and, in what kinds of instructional settings shall the competencies be taught? (Airasian 1973). The Performance Based Teacher Education (PBTE) movement intensifies these questions. As Johnson, et al, (1973) have indicated, competency based programs are founded on the basic assumption that a detailed description of the behaviors or competencies essential to effective teaching is outlined at the outset. Further, Berliner (1974) has indicated that these teacher competencies must necessarily have a relationship to pupil learnings and attitudes to be worth inculcating in teacher trainees. Rosenshine (1971) explains that traditionally teacher competencies taught in teacher education institutions are a result of professional intuition and past experience as opposed to coming out of a research

base. Furthermore, Hudgins, et al, (1974) indicate that in the area of teacher education, there is relatively little concensus as to a specialized vocabulary or set of concepts about teaching. They state that individual concepts about teaching are not widely shared among practitioners. Rather, there is a paucity of technical language available to teachers for talking about issues that occur in the classroom. No language of teaching exists that provides a set of tools by which practitioners can isolate areas of difficulty and subsequently comprehend and interpret them through reliable and widely shared forms of communication. They go on to state that concepts about teaching strategies available to teachers are often so limited in scope that the individual teacher is left with nothing but his own powers of insight and innovation to survive in the classroom.

The purpose of this research was not to set out specifically to identify what teacher competencies should be emphasized in a teacher education program but, rather, to develop a system for gathering more accurate and comprehensive information about the teaching act. Such an instrument could then be used through longitudinal studies to research which teacher competencies produce certain pupil learning. The typical research strategy for examining teaching limits itself to the gathering of antecedent data (pre-testing) and consequence data (post-testing) about what is going on in the classroom, seldom looking into the classroom to see how teachers actually teach. Null hypotheses are often not rejected based on the assumption that the experimental and control teaching patterns were not different where in actuality a closer look at what went on in the classroom would indicate just the opposite.

The system described in this research was generated on the assumption stated by Medley and Mitzel (1963) that there is no more obvious approach to research on teaching than direct observation of the behaviors of teachers and learners in the classroom.

Instruments for observing classroom interactions exist in abundance. Simon and

Boyer (1967, 1970), in their anthologies entitled Minors For Behavior, describe 92 observational systems. Seventy six of which have been used for observation of instruction in school settings. Interaction process analysis has been used to evaluate human interaction patterns since the late 1920's. Barr (1929) describes a study which attempted to measure the characteristic differences in the teaching performance of good and poor teachers of social studies. H. H. Anderson (1939), using an interactive analysis approach, assessed the "integrative" and "dominative" behavior of teachers in their contacts with children. Lewin, Lippitt, and White (1939) studied patterns of aggressive behavior in experimentally created "social climate" using direct observation techniques. One of the first early researchers to use a category system to classify teacher's statements was John Withall (1949).

Since these early attempts at direct observation of teaching, many systems have been developed by authors such as, Taba (1942), Amidon (1966), Bellack (1966), Flanders (1960), Spaulding (1965), Hughes (1959), and Hough (1966). One of the underlining assumptions of these interaction analysis systems is that since whatever effect a teacher has on pupils must result from his behaviors, it is then only necessary to identify crucial behaviors, record them, and score them properly to measure effectiveness in teaching. (Medley and Mitzel 1963).

In examining the vast amount of literature on interaction analysis techniques, it became apparent to the authors of this study that all of the present systems had some inherent weaknesses as well as strengths. As was stated earlier, the purpose of this research was to develop a system that would be accurate and comprehensive in its scope. Specifically, from reviewing the literature the authors set out to devise a system that would have the following characteristics: first of all, the data received would represent low-inference level behaviors, i.e., teacher and pupil behaviors would be observable and reliable as to the agreement of their occurrence. Secondly, a categorical system (Rosenshine 1973) would be

developed where all behaviors under observation would be recorded as they occurred. And thirdly, the system would allow for multiple coding (Rosenshine 1973) or modifying of specific behaviors. The authors also wanted a system that would eliminate the inherent problems of previous systems, such as recording time visually (looking at a clock), or having to manually write symbols on a fixed area which takes the observers view away from the interaction. Also, the authors set out to devise a system whose categories would represent actual teacher and pupil behaviors and at the same time be generic enough to classify the bulk of what was occuring in the instructional setting. At the outset the authors recognized that the act of teaching is so complex that any categorical system would necessarily be limited in its scope. And finally, the system would not only record frequencies of occurance but also sequences of specific teacher-pupil interactions.

METHOD AND DESIGN

Behavioral Objectives

In selecting the specific interaction categories for this research, the authors chose to move away from the classic paradigms of direct and indirect teacher categories as described by Flanders and Hough (Amidon 1967), or the Verbal Interaction Categories described by Amidon (1967) to those categories that more closely followed the operant learning model.

Specifically, the teaching act was described in terms of those teacher acts that elicited pupil responses and those which followed an elicited or emitted learner response.

Fifteen behavior categories were identified (seven for the teacher and eight for the learner). Five categories were listed as preceding teacher stimuli (elicitors.) These were divided into three classes of "Shows Task" behaviors, "Task Signal" behaviors, and "Management Signals". "Shows Tasks" behaviors included (E) Explains task to learner-content explanation, and (M) Models the task response. "Task Signal" behaviors include (?) Asking a question to get a task response going, and (D) Giving a direct signal to get a task going (verbal or gesture). "Management Signals" had the one behavior of (C) Controling management behavior with direction statements or gestures.

Consequent teacher stimuli were divided into (+) Giving a positive, affirmative statement or gesture, and (-) Giving a negative statement or gesture.

The eight pupil responses were first divided into "On Task Responses", "Off Task Responses" and "Other Learner Responses . "On Task" responses included; (OD) Student giving an overt response which cannot be judged correct or incorrect until later, (+) A correct learner response with relationship to task signals, (-) An incorrect learner response with relationship to task signals, (Ø) Learner gives no response with relationship to task signals, and (?) Learner asks a question about task, asks for clarification.

"Off Task" learner responses included (+) Learner giving positive statement or gesture (not related to task), and (-) Learner eliciting an inappropriate management behavior.

"Other" learner responses included all the above learner responses but were distinguished with the preceding symbol of (0). The following is a listing of the teacher - pupil response variables (categories).

Teacher Preceding Stimuli

Shows Task

(Operant Symbol)			(Typewriter Symbol)
SE	(E)	- Explains task to learner - content explanation	(r)
SM	(M)	- Models the task response	(t)

Task Signals

S?	(?)	- Asks a question to get task response going	(y)
SDT	(D)	- Gives a direct signal to get task going (verbals or gestures)	(u)

Management Signals

SCB	(C)	- Controls management behavior with direction statements or gestures	(i)

Teacher Consequence Stimuli

S+	(+)	- Gives a positive, affirmative, statement or gesture	(o)
S-	(-)	- Gives a negative statement or gesture	(p)

Pupil Responses

On Task Responses

ROD	(OD)	- Student gives an overt response which cannot be judged correct or incorrect until later.	(d)
R+	(+)	- A correct learner response with relationship to task signals	(f)
R-	(-)	An incorrect learner response with relationship to task signals	(g)

R∅ (∅) - Learner gives no response with relationship to task signals (h)

R? (?) - Learner asks a question about task, asks for clarification (k)

Off Task Response

R(+) (+) - Learner gives positive statement or gestures (k)

R(-) (-) - Learner elicits inapropraite management behavior (l)

Other Learner Responses

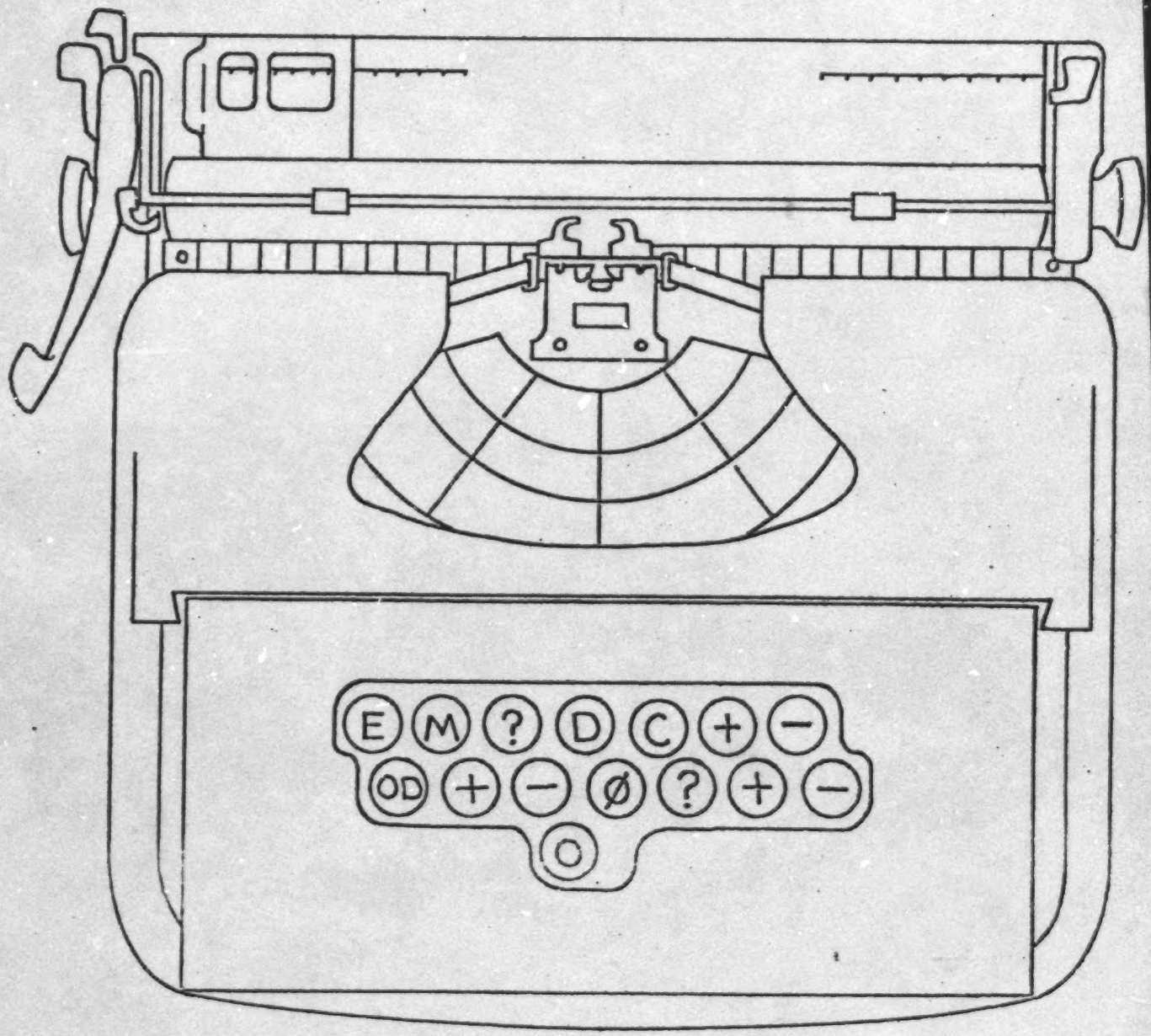
*RO() (O) - Other learner (than one being observed) gives response as teacher calls on him (Hit O key and then the kind of response i.e.,OD,-,,?,-,-.) (b)

*Possible outcomes for an RO () are:

RO (R+)
RO (ROD)
RO (R-)
RO (R∅)
RO (R?)
RO (RO(+))
RO (RO(-))

Instrumentation

The authors explored several ways of recording the above categories with paper-pencil techniques, all of which had the limitations previously described. Finally it was hit upon to use a modified typewriter as the recording instrument. The typewriter had the capacity to record many variables e.g. each typewriter key could stand for a specific variable under observation. Regular touch key symbols were substituted with symbols for the variables under observation (See Figure I). Also, by using the typewriter the observer after memorizing the modified symbols could keep his vision on the teacher-pupil interactions. The typewriter also had the unique quality of recording each symbol sequentially so that a quick and accurate sequential record recorded with each strike of the key. (See Figure 2).



A Modified Typewriter System for Gathering Data

Figure 1

Teacher-Learner Observation Record

Teacher Christiansen Grade 1st Observer Von Hansen

School Oren Elem Room ____ Date 28 Oct 74 4

Time Block A (Learner Fay 3)

1 ybfyhurufoyhyhr
2 iybfoyuhrudyhuf
3 rutd
4 iuyfiuitdybforti
5 ryhtudob

Spelling words on ward

Time Block B (Learner Sue 2)

1 iufyfufyobygygpygpygp
2 rtudygryfy
3 rbufufufufbjobjouf
4 obuubrufib
5 uyd

spelling words

Time Block C (Learner Craig /)

1 udifydob
2 oufyfyhufor
3 yfyfud
4 ibybfotryhtob
5 yhtdryhydyjboybfo

Sample of the Data Record

Figure 2

To eliminate the problem of counting time either verbally or visually, the authors made a cassette tape which gave a signal to the observer of when to begin an observation and when to stop. This tape was listened to through a small earphone.

Observation Procedures

To use the typewriter recording system, an observer would seat himself in the classroom where he could readily observe three pupils and their teacher in an instructional mode. The observer, after turning on the tape recorder, would observe one of the three pupils for a total of five one-minute intervals, (being signaled by the taperecorder when each one-minute period would begin and stop). There was a 15 second non-observation interval between each minute of observation. During each minute of observation the observer would record on the typewriter each different teacher behavior, as they occurred, in sequence of followed by every different learner behavior of the pupil under observation. After recording five one-minute "windows" of behavior for the first pupil, he would proceed to observe the other two pupils for five one-minute periods.

If during an observation of a particular student the teacher directed her task signals specifically to another child, the observer would hit the "Other" key (0) and record this child's response.

Research Design

For this particular research the authors wanted to test the typewriter system to see if; one, it could isolate specific patterns of teacher-pupil interactions, and two, would these patterns reflect levels of teacher competence.

Twelve public school teachers were classified for the study into four categories each containing three teachers. The groupings were as follows:

Category 1 - Tenured teachers, teaching language arts in Grades 1 or 2, who were considered by the district supervisory committee as being outstanding teachers of reading instruction.

Category 2 - Tenured teachers with the same assignment who were considered by the district supervisory committee as being poor teachers of reading instruction.

Category 3 - Elementary Education graduates trained at Brigham Young University (BYU) who were entering the school district as first year teachers with the same grade assignment as above.

Category 4 - Undergraduate students who had entered the teacher training program at the BYU and had not received course work in reading instruction, but who were on a one semester assignment to work mornings as Teacher Assistants in the district school system. These assignments were also in grades 1 and 2.

All teachers were asked to teach specifically in the area of reading thus portraying a more accurate picture of interaction relationships. Raw data from the typewriter record sheets was punched on to computer cards for analysis.

All gathered data was converted into rated data. This was done by dividing the total number of minutes of observation for a given day into the total of each behavioral category observed that day. This approach allowed the authors to compare multiple variables using a ratio scale. Also percent of occurrence for each category was computed from the nominal data.

Rates were compared in terms of single behavioral category rates by teacher, student, and by day, and by category, i.e., excellent, poor, 1st year, and TA. A summary matrix by day, by teacher and by category showed the pairing of specific behavioral categories. These were used to analyze the differences in patterns by teacher and by category.

A summary syntax approach was also used to provide the researchers with a graphic visual of the sequential flow of the instructional patterns obtained within each minute of observation. Figure 3 shows an example of a computer printout using the syntax system.

```
SDT     RO ( R+ )
S?
SCB     RO
****
**** TEACHER: 4  DAY: 5  STUDENT: 1
        RO ( R+ ) S+
S?      R+
SDT     R+        S+
S?      RO ( R+ ) S+
S?      RO ( R+ )
SDT     RO ( R+ ) S+
S?      R+        S+
S?      R-
S?      R+        S+
****
SM
S?      RO ( R+ ) S+
S?      RO ( R+ )
S?
SCB     RO
SDT     RO ( R- )
SDT     R+
S?      RO ( R- ) S-
****
S?      RO ( R- ) S-
S?      RO ( R+ ) S+
SDT     RO
S?      R+        S+
S?      RO ( R- ) S-
S?      RO ( R+ ) S+
S?
****
SE
S?      RO ( R+ ) S+
SE
S?      RO ( R+ )
SDT     RO
SCB     RO ( R+ ) S+
S?      RO
S?
SCB     RO
****
                  S-
SE
S?      RO ( R- )
SE
S?
S?      RO ( RW )
S?      RO ( R+ ) S+
S?      RO ( R+ )
SM      R+        S+
S?      RO
****
**** TEACHER: 4  DAY: 5  STUDENT: 2
S?      RO ( R- ) S-
SE
S?      RO
SDT     RO
```

ONE MINUTE

Computer printout of the syntax configurations based on one minute intervals

Figure 3

RESULTS

The purpose of this research was to develop an interaction analysis system that could accurately distinguish different levels of teacher competence and different teacher-pupil interaction patterns.

Tables 1A and 1B present the mean rates of occurence per minute for the teacher eliciting and consequating behaviors and the pupil elicited and emitted behaviors by teachers and by category. An analysis of these data shows that among other things, for the eliciting behaviors, Category 1 (experienced teachers) as a group, had the highest rates of (E) Content explanation (Rate 1.63/min.) while Category 4 (teacher assistants) as a group had the lowest rates of (E) Content explanation (Rate .19/min.) compared to all four categories. Yet, the poorer rated teachers, category 2, had the highest rates of (M) Modeling (Rate .48/min) and (?) questioning (Rate 2.77/min).

Other interesting summaries showed that the teachers rated excellent had the highest rate of (C) controlling behavior (Rate .55/min) while the teacher assistants had the lowest rate (.16/min). Teacher assistants had the highest rate of (+) praising (3.35/min) while the poorer rated teachers had the lowest rate of (+) praising (1.14/min) and the highest rate of (-) negatively consequating (.27/min). Teacher assistants also had the highest rate of correct responding (4.94/min) while the poorer rated teachers had the lowest rate of correct pupil responses (3.44/min). Conversely, the teacher assistants also had the highest rate of incorrect pupil responses (.77/min) while the excellent rated teachers had the lowest rate of incorrect pupil responding (.18/min). Both the excellent and poor rated teachers rated low for inappropriate pupil behaviors (.09/min for both categories) while the first year teachers and teacher assistants had the highest rates of inappropriate student behaviors (.14/min. for both categories). Table 1A and 1B contain a complete tabulation of all rated data.

Mean Rate of Occurrence Per Minute of the
Teacher/Pupil Variables
By Teacher and by Category

BEHAVIOR	GROUP 1				GROUP 2			
	Teacher #1	Teacher #2	Teacher #3	Group #1 Combined	Teacher #4	Teacher #5	Teacher #6	Group #2 Combined
Content Explanation	2.02	1.52	1.33	1.63 **	1.56	1.73	.74	1.40
Models	.35	.57	.04	.31	.13	1.03	.14	.48 **
Questions	1.67	1.68	3.07	2.15	3.61	2.95	1.54	2.77 **
Direction	3.09	4.27	2.68	3.33 **	1.57	2.20	2.90	2.17
Controls	.51	.61	.55	.55 **	.75	.40	.39	.52
+ Praise	1.06	1.54	1.94	1.51	1.27	1.50	.50	1.14*
- Praise	.04	.02	.04	.03 *	.48	.10	.27	.27 **
Overt Delayed Response	0.78	.60	.14	.51	.05	.70	.82	.52
Correct Response	2.93	3.95	4.34	3.73	3.01	3.04	4.55	3.44 *
Incorrect Response	.12	.18	.22	.18 *	.80	.31	.42	.50
No Response	.66	.91	.74	.76	.70	.81	.33	.64
Student Asks A Question	.31	.20	.07	.20	.05	.23	.17	.15
Positive Statement	.08	.09	.06	.08 **	.05	.08	.02	.05
Inappropriate Behavior	.05	.14	.08	.09 *	.13	.04	.13	.09 *
Other Learner	2.01	2.26	3.31	2.53	4.62	2.90	4.07	3.79 **

Table 1A

** Highest rate for behavior by Category

* Lowest rate for behavior by Category

Mean Rate of Occurrence Per Minute Of The
Teacher/Pupil Variable
by Teacher and by Category

BEHAVIOR	GROUP 3				GROUP 4			
	Teacher 7	Teacher 8	Teacher 9	Group #3 Combined	Teacher 10	Teacher 11	Teacher 12	Group #4 Combined
Content Explanation	1.93	1.55	.88	1.41	.22	.26	.10	.19*
Models	.20	.27	.33	.27	.36	.43	.03	.26*
Questions	1.81	2.71	3.08	2.59	1.91	2.03	1.70	1.86*
Direction	1.55	1.47	2.60	1.92*	4.19	3.17	1.07	2.90
Controls	1.11	.27	.23	.49	.20	.26	.04	.16*
+ Praise	1.28	.67	1.82	1.27	2.42	3.75	4.29	3.35*
- Praise	.06	.19	.12	.13	.06	.02	.02	.04
Overt Delayed Response	.28	.82	.49	.55**	.02	.50	.00	.12*
Correct Response	1.97	3.64	4.63	3.54	5.23	4.43	4.87	4.94**
Incorrect Response	.19	.29	.36	.29*	.36	.21	1.64	.77**
No Response	.50	.13	.35	.31	.18	.20	.02	.13
Student Asks A Question	.30	.56	.15	.33**	.20	.06	.09	.13**
Positive Statement	.08	.05	.07	.07	.02	.02	.03	.02*
Inappropriate Behavior	.42	.03	.04	.14**	.20	.18	.05	.14**
Other Learner	3.33	4.49	2.92	3.58	2.11	1.64	.01	1.29*

1B

** Highest rate for behavior by Category
* Lowest rate for behavior by Category

Further analyses illustrated the percentage of occurrence of the teacher-pupil behaviors by teacher and by category. Some of the higher and lower percentages that occurred are presented in the following paragraphs. For a complete analysis of these percentages, see table 2.

Categories one and two consumed the largest percentage of their behaviors with correct pupil responding, the teacher assistants having the highest percentage of occurrence with 30%, the excellent rated teachers, 21%, the poorer rated teachers and first year teachers consummed their highest behavior occurrence with (0) other learner responding (21% for both categories).

Compared across categories, the poorer rated teachers had the lowest percentage of occurrence for correct responding (19%), the teacher assistant, the highest (30%). Excellent rated teachers had the highest percentage of giving directions (18%) while the first year teachers had the lowest, (11%). The excellent rated teachers also had the highest percentage of occurrence for controlling their pupils (39%) while the teacher assistant had the lowest (0%).

To analyze the different types of behavior patterns, a matrix was generated which shows which teacher-pupil behaviors elicited and consequated each other. Table 3 takes all of the behavioral variables observed in the study and pairs them as preceding stimuli (elicitors) with the three pupil responses of correct (R+), incorrect (R-) and no response (RØ). The mean rate of occurrence for each of these pairs by category is presented. Table 4 takes all of the behavioral variables observed and pairs them as consequent stimuli with the three pupil responses of correct (R+), incorrect (R-), and no response (RØ). Again, the mean rate of occurrence for each of these pairs is presented by category.

Some of the interesting distinguishing rates from Table 3 include the following: excellent rated teachers (Category 1) had the highest rate of using modeling (SM) to elicit a correct response (.09/min) whereas the poorer rated teachers (Category 2) had the lowest rate of modeling to elicit a correct

PERCENT OF OCCURRENCE OF THE TEACHER/PUPIL VARIABLES BY TEACHER AND BY CATEGORY

BEHAVIOR	Symbol	CATEGORY #1				CATEGORY #2				CATEGORY #3				CATEGORY #4			
		Teacher 1	Teacher 2	Teacher 3	Combined	Teacher 4	Teacher 5	Teacher 6	Combined	Teacher 7	Teacher 8	Teacher 9	Combined	Teacher 10	Teacher 11	Teacher 12	Combined
Content Explanation	E	12	8	7	9**	8	9	4	7	12	9	4	8	1	1	0	1*
Models	M	2	3	0	1*	0	5	0	2**	1	1	1	1*	2	2	0	1*
Questions	?	10	9	16	12	19	16	9	15**	12	15	17	15**	10	11	12	11*
Direction	D	19	23	14	18**	8	12	17	12	10	8	14	11*	23	18	7	17
Controls	CB	3	3	2	3**	4	2	2	2	7	1	1	2	1	1	0	0*
Positive Praise	+	6	8	10	8	6	8	2	6*	8	3	10	7	13	21	30	20**
Negative Praise	-	0	0	0	0	2	0	1	1	0	1	0	0	0	0	0	0
Overt Delayed Response	OD	4	3	0	2	0	3	4	2	1	4	2	3**	0	2	0	0*
Correct Response	+	18	21	23	21	16	16	26	19*	13	21	25	20	29	25	34	30**
Incorrect Response	-	0	0	1	0*	4	1	2	2	1	1	1	1	2	1	11	4**
No Response	+	4	4	3	4**	3	4	1	3	3	0	1	1	1	1	0	0*
Asks a Question	?	2	1	0	1**	0	1	1	0*	1	3	0	1**	1	0	0	0*
Positive Statement	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inappropriate Behavior	-	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0
Other Learner	O	12	12	17	14	24	16	23	21**	22	26	16	21**	11	9	0	7*

TABLE 2

** Highest percentage for behavior by category
* Lowest percentage for behavior by category

Mean Rates for Patterns of Preceding Stimuli As An Elicitor
Of Correct, Incorrect and No Response By Category

	Correct Response				Incorrect Response				No Response			
	Cat. #1	Cat. #2	Cat. #3	Cat. #4	Cat. #1	Cat. #2	Cat. #3	Cat. #4	Cat. #1	Cat. #2	Cat. #3	Cat. #4
SE → R	.01*	.01*	.03**	.02	.00	.00	.00	.00	.00	.00	.00	.00
SM → R	.09**	.04*	.05	.12	.00	.00	.00	.00	.00	.00	.01**	.00
S? → R	.54	.35*	.70	1.15**	.04*	.02*	.05	.12 **	.31**	.29	.12	.04*
SD → R	1.86**	.71*	.75	1.76	.03*	.03*	.05	.15 **	.34**	.11	.05*	.05*
SC → R	.02	.01*	.03**	.01*	.00	.00	.00	.00	.00	.00	.00	.00
S+ → R	.00	.00	.00	.77**	.00	.00	.00	.31 **	.00	.00	.00	.01
S- → R	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ROD → R	.00	.00	.00	.03**	.00	.00	.00	.00	.00	.00	.00	.00
R+ → R	.00*	.05*	.01	.03	.01*	.01*	.00	.09**	.00	.00	.00	.00
R- → R	.00	.00	.00	.01**	.00	.00	.00	.00	.00	.00	.00	.00
R@ → R	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
R? → R	.00	.00	.00	.01**	.00	.00	.00	.00	.00	.00	.00	.00
R(+) → R	.00	.00	.00	.01**	.00	.00	.00	.00	.00	.00	.00	.00
R(-) → R	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

**Highest rate for behavior pairs by category

*Lowest rate for behavior pairs by category

Table 3

Mean Rates for Patterns of Consequent Stimuli As Elicited
By Correct, Incorrect and No Response By Category

	Correct Response R+				Incorrect Response R-				No Response RØ			
	Cat.1	Cat.2	Cat.3	Cat.4	Cat.1	Cat.2	Cat.3	Cat.4	Cat.1	Cat.2	Cat.3	Cat.4
R→SE	.381**	.316	.236	.013*	.069	.144**	.042	.030 *	.125**	.116	.059*	.011
R→SM	.032*	.038	.063	.073**	- *	.008	.033**	.023	.010*	.014	.027**	.021
R→S?	.555	.572	1.014**	.333*	.047*	.123	.051	.531**	.209	.265**	.104	.039*
R→SDT	1.257**	.724	.677*	.880	.022	.036	.030	.143**	.235**	.112	.058	.032*
R→SCB	.148**	.095	.101	.008*	.002*	.011**	.010	.002*	.029**	.028	.021	- *
R→S+	1.066	.954*	1.000	3.233**	.015**	.008	.007	.004*	.059**	.021	.015	- *
R→S-	.006	.021**	.007	- *	.010*	.151**	.097	.011	.003	.014**	.001	- *
R→ROD	.001	.001	.003**	- *	-	-	-	-	-	-	.001**	-
R→R+	.002*	.051**	.012	.034	.003	.004	-*	.013**	.003**	.002	-*	.002
R→R-	.007	.006	.003*	.086**	-	-	-	-	-	-	-	-
R→RØ	.001	.001	.003**	- *	-	-	-	-	-	.001**	.001**	-
R→R?	.005*	.020	.079**	.011	- *	- *	.001	.002 **	.003	.006**	.001	- *
R→R(+)	.010	.007	.016**	.002*	-	-	-	-	-	-	.001**	-
R→R(-)	.006*	.015	.016**	.009	.002	.004**	.001	- *	.021**	.002*	.008	.002*
R→RO	.039	.368**	.027*	.077	-	-	.006**	-	.014	.012	.001*	.021**

**Highest rate for behavior pairs by category

*Lowest rate for behavior pairs by category

Table 4

response (.04/min). Category 4, (teacher assistants) had the highest rate of using questions (S?) to elicit a correct response (1.15/min) whereas Category 2 (poorer teachers) had the lowest rate of questioning to elicit correct pupil responding (.35/min). Category 1 teachers had the highest rate of giving a direction to elicit a correct response (1.86/min) whereas Category 2 teachers had the lowest (.71/min).

For incorrect responses, Table 3 shows that teacher assistants (Category 4) had the highest rates of incorrect responses elicited by questions (S?) and directions (SD) (rates .12/min and .15/min respectively). No response behaviors (RØ) elicited by questioning occurred at the highest rate for Category 1 teachers (.31/min) and lowest for Category 4 teachers (.04/min).

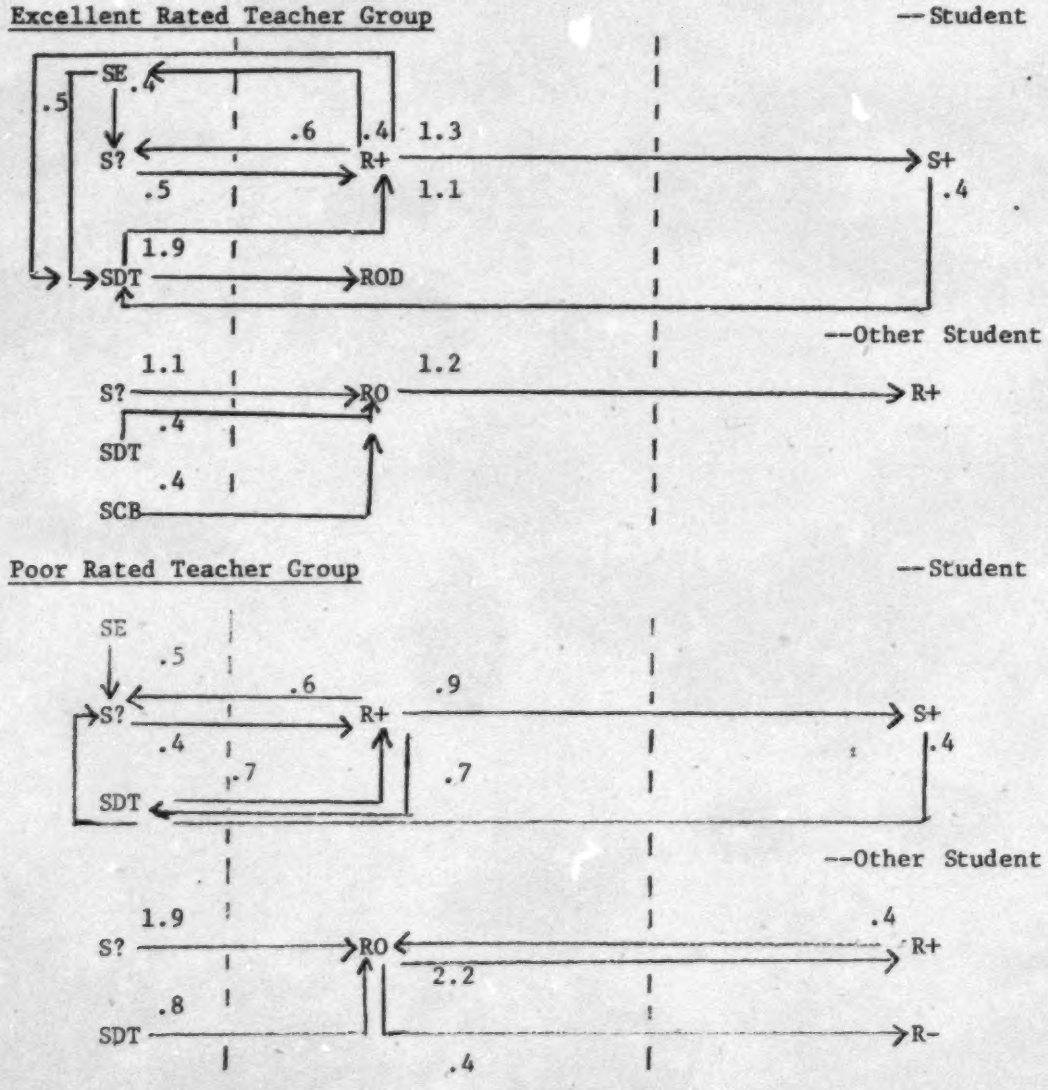
Directions followed by a no response, (RØ) occurred at a higher rate for Category 1 teachers (.34/min) and lowest for Category 3 and 4 teachers (.05/min for both 3 and 4).

Table 4 data indicated the following highlighted behavioral patterns. For the correct response (R+) acting as an elicitor of further explanations (SE) the excellent rated teachers had the highest rate (.381/min) the teacher assistants the lowest (.013/min). Teacher assistants on the other hand followed correct responses (R+) with modeling (SM) at the highest rate (.073/min) while excellent rated teachers did this the least (.032/min). Excellent teachers had the highest rate of following a correct response (R+) with further directions (SDT) (1.25/min). Teacher assistants followed correct responses (R+) with the highest amount of positive consequences (S+) (3.233/min), poorer rated teachers the least (.954/min).

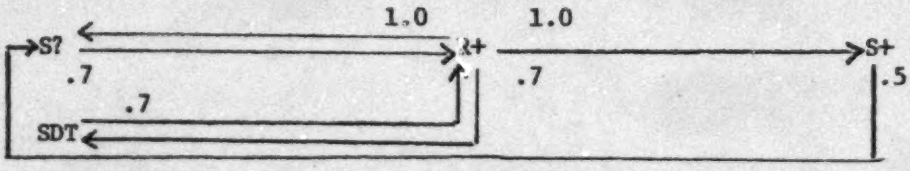
For incorrect responses (R-) Table 4 shows that poorer rated teachers consequated these with further explantions at a higher rate than other categories (.144/min). Whereas, the teacher assistants followed incorrect

responses (R-) mostly with questions (S?) (.53i/min) and directions (SDT) .143/min). Interestingly, excellent rated teachers followed incorrect responses with the highest rate of positive consequences (S+) (.015/min) compared to the other categories. No responses (RØ) in table 4 indicate, among other things, that poorer rated teachers followed these at a higher rate (.265/min) with further questions (S?) whereas the excellent rated teacher would follow a no response at a higher rate (.235/min) with more directions.

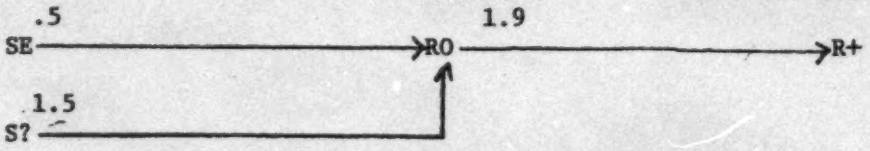
The syntax interaction configurations found in this study summarizing the .4 or better frequencies for each of the four teacher categories follows:



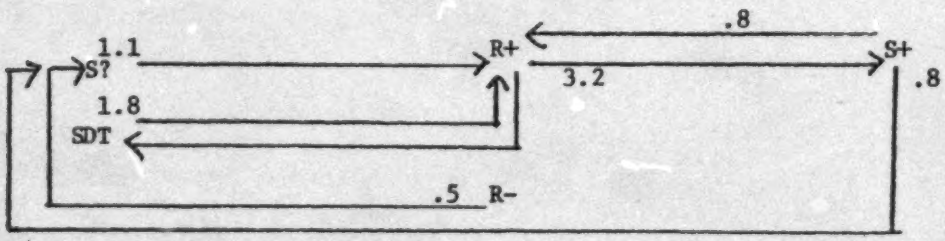
1st Year Teacher Group — Student



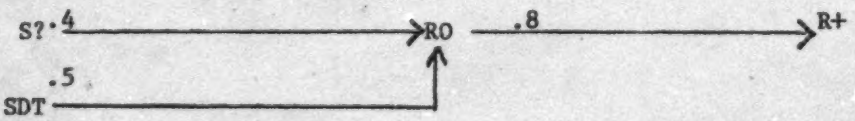
—Other Student



Teacher Assistant Group — Student



—Other Student



From the above syntax, the researcher can visually grasp the flow of the various interaction patterns and their rates of occurrence.

SUMMARY

The resulting data from this research have demonstrated that indeed the modified typewriter interaction analysis system developed by the authors has the capacities set out at the beginning of this research. Specifically, using this system, an observer is able to record specific teacher-pupil behaviors as they interact in an instructional setting and distinguish accurately and comprehensively the cause and effect relationships. Furthermore, this system has the capability to distinguish patterns of behavior between different teachers in such a manner that objective analyses can be made with regards to their individual competence. The authors recognize that longitudinal studies using systems like the one described in this research can and will further the task of bridging the gap between what is felt is good teaching and what is indeed good teaching - what actually causes pupils to learn.

CURRENT EXTENTION OF THE STUDY

Based on the findings from this study the authors are encouraged to replicate the research in another district this fall. Also the authors have set out to improve upon the limitations found inherent in the typewriter system. First, there was a problem of converting typewriter data to computer form. This task became very time consuming and reduced the ability to handle large amounts of this form of time series data in the future. Second, in looking at the difference in the rate of praise given in each category, the authors questioned the concept of duration of time spent in praising, etc. A duration measure will provide a more meaningful analysis of the category event.

In the approach to solve these defiances the authors turn to micro computer technology and developed a customized system called TICOR. TICOR is an acronym for Time Interval and Categorical Observation Recorder.

The present TICOR system includes the following components:

1. An alpha-numeric computer terminal keyboard with standard typewriter key layout plus some extra keys for entering data, controlling the micro computer, and controlling communication with a larger computer. In recording data, observers depress a key associated with a behavioral category and hold the key depressed for the duration of the performance interval. The micro computer records the particular key depressed, the duration of depression, and the null time or duration between key depressions.

2. A general purpose, programmable computer system using the most modern micro computer components available including a minimum of 2048 electronic storage locations which allow for the storage of approximately 480 activity observations. To facilitate the control of observational time segments, the activation of an audio signal device is under programmable control.

3. An audio cassette recorder with which the entire electronic data storage

can be stored on about 2 minutes of tape. This provides a convenient means for permanently storing very large amounts of data.

4. An acoustic coupler which enables the transmission of data from the micro computer to a larger computer for analysis through an ordinary telephone handset.

The authors have designed the TICOR system to be expandable in a number of ways to further facilitate interaction analysis research. The number of keyboards may be expanded to at least three separate boards. This will allow for the observation of three different interactions simultaneously or for the observation of three individuals and the analysis of interruptions or other types of simultaneous or parallel behavior. The multiple keyboards will also allow two or more observers to observe the same behavior to establish the reliability of observations. The amount of electronic data storage can be expanded to about 65,000 locations. Along with this expanded storage the micro computer can be expanded in program capacity to provide for data analysis and feedback without the use of a larger computer. Such analysis might include inter-observer reliability coefficients and closeness of fit of observed behavior patterns to a standardized or optimal pattern. The results of these analyses could be displayed on a video screen or on an attached printer.

Implications of TICOR for research, training, and evaluation

As a tool for research in teacher evaluation the TICOR system offers a number of advantages over most alternative approaches to recording interaction data. The cost of the TICOR system is about the same as a standard electric typewriter. The system is composed of lightweight briefcase sized modules, utilizes a silent keyboard, and has an internal power supply to facilitate on site data recording. The data is recorded directly in machine readable form which not only eliminates transcription errors, but also allows the researcher to communicate directly with a large time sharing computer for complex data analyses.

municate directly with a large time sharing computer for complex data analyses. Either the data can be transmitted via telephone or the cassettes can be mailed.

Another major research advantage is the flexibility of the system. The behavioral categories can be changed to fit varying situations or to experiment with new systems. Currently programs have been written to analyze the data as frequencies per unit time, total time of categories, S-R-S sequences, and logarithmic plots. Hypotheses generated by the most sophisticated teacher-student interaction theories should be readily testable.

As a teacher trainer or inservice training tool the system has much to offer. Many of the teacher training institutions within the United States are moving towards competency based teacher education programs (CBTE) which in order to be viable must be built on a data base. Over the years interaction process analysis research has generated over 600 interaction variables. Much of the CBTE thrust is being built on the findings of the interaction researcher. What the CBTE people currently need is hard summative data on the primary mix of teacher competencies normed on an effective teacher model. They also need summative evaluations on teacher training. TICOR's unique flexibility allows the user the ability to constantly modify the keyboard to stay current with CBTE development. The system can be used to gather formative and summative data on teacher training program development, teacher trainee progress, competency discriminiation, and feedback. Current research at Brigham Young University is exploring multiple ways that the TICOR system can be interfaced with teacher training institutions using the CBTE model.

As an evaluation tool TICOR can be used to monitor and evaluate both teacher/pupil instructional strategies, and curricula development. Wadham and Young have carried out a series of product evaluation studies (not reported in this paper) using an earlier development of the present system. These studies show that

curriculum materials can be effectively evaluated without the expense of a heavy outlay in time and money. In the study of instructional strategies (reported above) the new system will allow the researcher to identify the teacher stimuli being used to elicit correct, incorrect or no response, and the teacher stimuli being used to reinforce correct responses, remediate an incorrect response, or facilitate a response to a no response. These rate, sequence, and duration investigations will continue to add new insights to the study of effective instructional strategies and teacher pupil behavior.

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ERRATA SHEET

To accompany paper entitled, "A Simplified Evaluation Program to Distinguish Levels of Teacher Competence and Teacher-Pupil Interaction Patterns Based on Pupil Responses."

ABSTRACT - Para. 2, Line 6, last word, change "these" to read "those".

PAGE 1 - Para. 3, Line 1, change ; to : after "of".

PAGE 3 - Para. 1, line 1, change "Minors" to read "Mirrors".

PAGE 3 - Para. 1, line 10, 1st word, change "climate" to read "climates".

PAGE 7 - Line 6 (from top of page), change "inapropraite" to read "inappropriate".

PAGE 10 - Para. 2, Line 8, omit "of" after "sequence", insert a comma (,).

PAGE 16 - Para. 2, Line 4, 5th word "consummed" change to "consumed".

PAGE 16 - Para. 3, line 5, change "(39%)" to "(3%)".

PAGE 20 - Para. 5, Line 2, 5th word, "explantions" change to "explanations".

PAGE 24 - Para. 2, Line 1, 7th word "defiances" change to "deficiencies".

PAGE 25 - Omit last line of page

PAGE 26 - Para. 3, Line 12, 7th word "discriminiation" change to "discrimination".

PAGE 26 - Para. 4, Line 2, Omit comma after "strategies".

PAGE 29 - Withall reference - Capitalize "Development" in title.